Top W Helicity Measurement - Update

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Introduction

- physics motivation
- measurement strategy

Samples

- lepton+jets
- lepton+track

Parameter and Confidence Interval Estimation

- the likelihood function and fitter
- confidence interval estimation
- the Feldman-Cousins method

Conclusions

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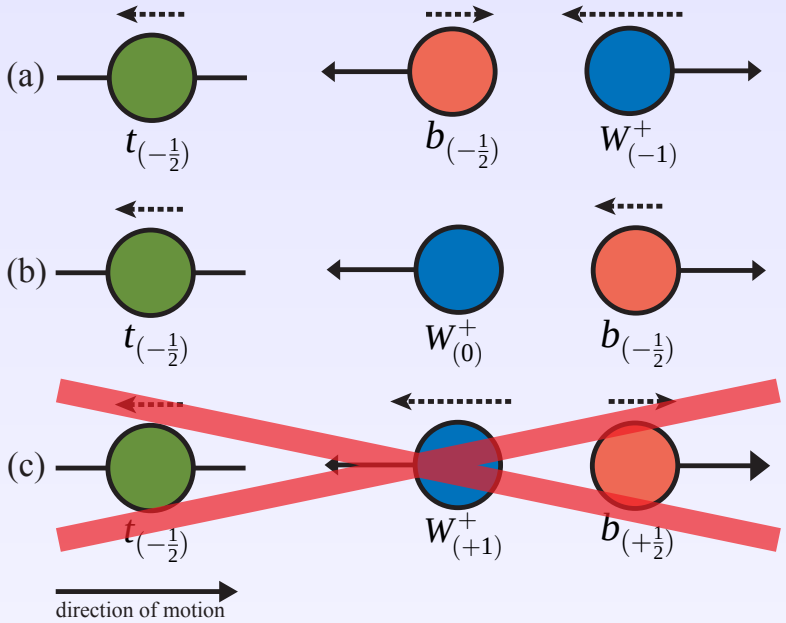

- SM: Only left-handed and longitudinal W's may be produced in the top-quark rest frame.
- SM: $t \longrightarrow W_0^+ b$ is enhanced

$$F_0 = \left(1 + 2\left(\frac{m_W}{m_t}\right)^2\right)^{-1} \simeq 0.7$$

$$F_R \simeq 0$$

- Exploring the the tWb coupling should lend insight to the nature of EWSB.
- It's a reasonable place to look for new physics.
- It provides us with opportunity to test predictions of the SM.

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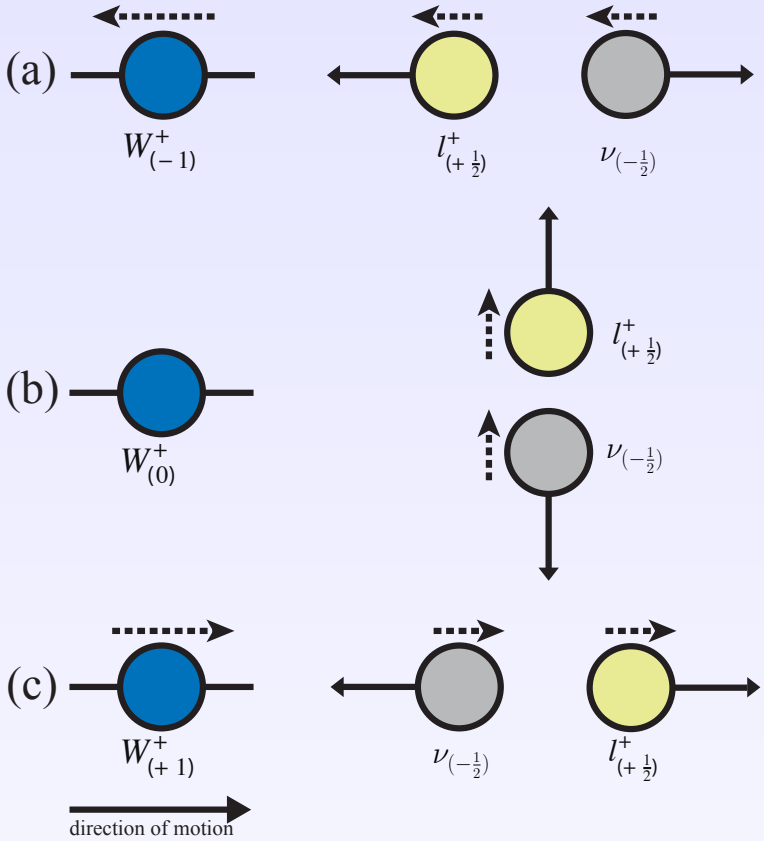

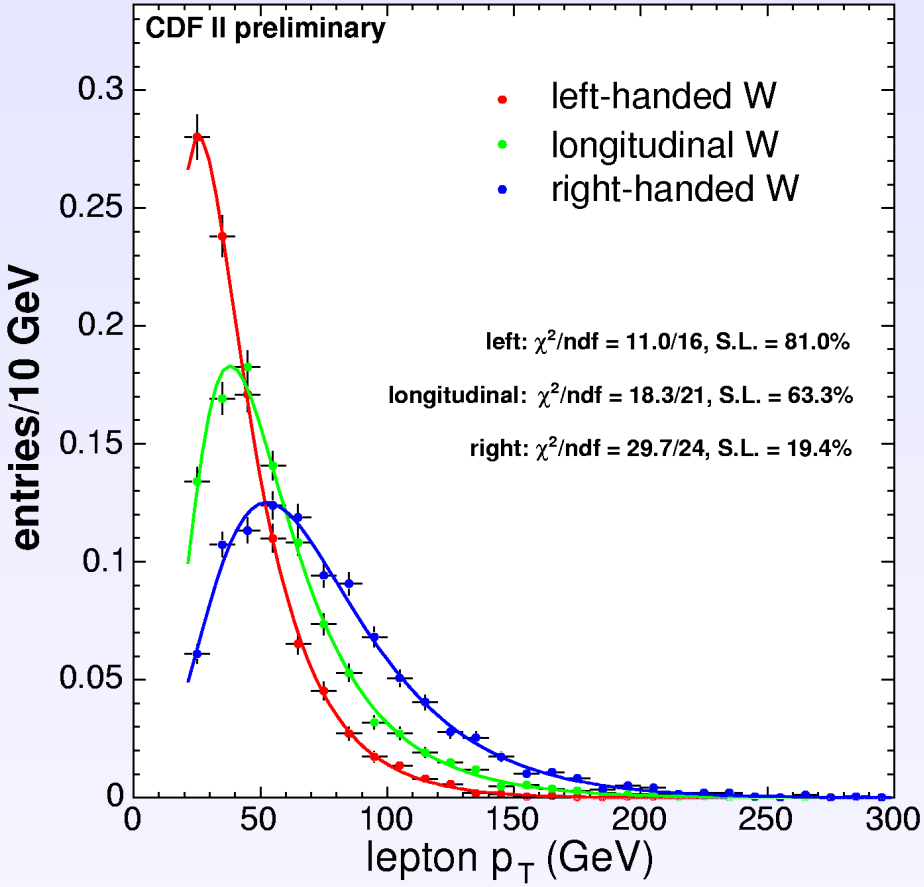

- Charged-lepton p_T is affected by the W helicity.
- We can estimate the helicity content of $t\bar{t}$ samples by analyzing their charged-lepton p_T distributions.
- We accomplish this by doing unbinned maximum-likelihood fits to the data.

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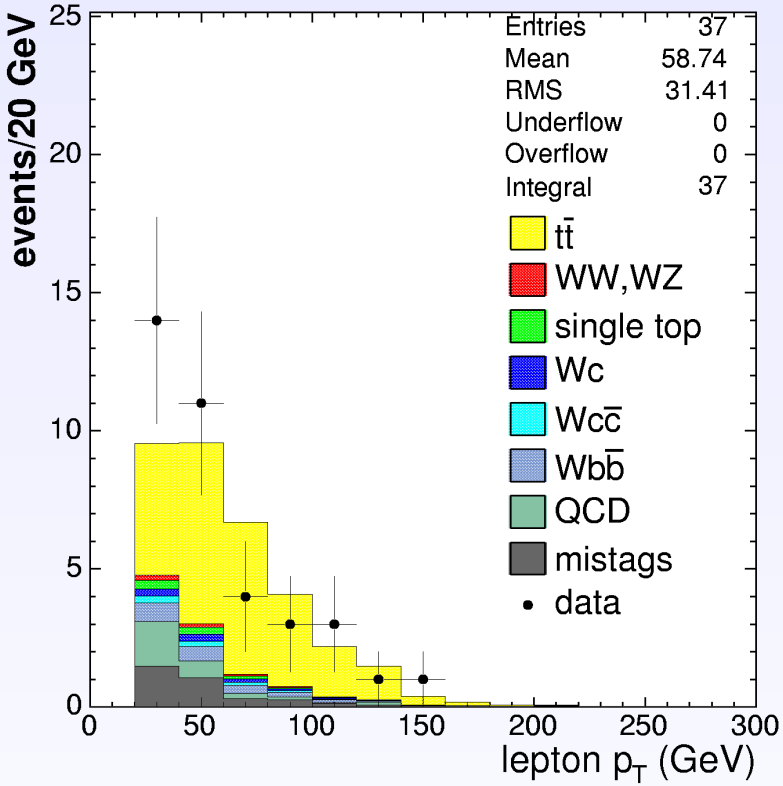
lepton+jets dataset

- We're investigating the use of "optimized" event selection (L4 or L5 jet-corrected $\not\!\!E_T$, L4 jet $E_T > 20 GeV$, $\Delta\phi$ cut).
- Stephen just discussed the status of the Method 2 bg estimates for the $\sim 170\ pb^{-1}$ dataset.
- Everything else is (more or less) in hand (e.g. lepton p_T shapes from standard MC samples, events from the data).



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lepton+track dataset

- We're working to incorporate the lepton+track dataset and b.g. estimates into this analysis.
- The l+track group has agreed to provide us with histograms of lepton p_T which we'll use model the background content of those samples.
- They also agreed to run their event selection on the fixed-helicity `HERWIG 6.5x` MC samples and provide us with histograms to model the signal.
- We thank them for their kind assistance.

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the likelihood function and fitter

- The overall form of the likelihood function will be unchanged from LP 2003.
- However, we are going to separate samples by primary lepton type,

$$\mathscr{L} = \prod_{s=1}^{S} G(\beta_s; \mu_s, \sigma_s) \prod_{t=1}^{T_s} \prod_{i=1}^{N_{st}} P_{st}(x_i; F_0, F_R, \beta_s).$$

- We have completely re-written the code which negotiates minimization of $-\log(\mathscr{L})$ by `MINUIT`.
- We now properly handle situations where $P_{st}(x_i; \mathbf{p}) \leq 0$; the new fit procedure is more robust.

confidence interval estimation

- Last time we had trouble where some of the data was very unlikely, given our model.
- $F_0 \in [0, 1]$, however in one case, our estimator $\hat{F}_0$ was well outside the defined range.
- In Run I we had a situation where the estimator was in the defined range, but the 1σ interval was not.
- We've adopted a policy which will avoid these problems and allow us to make coherent statements about the true values F_0 and F_R for all possible outcomes.

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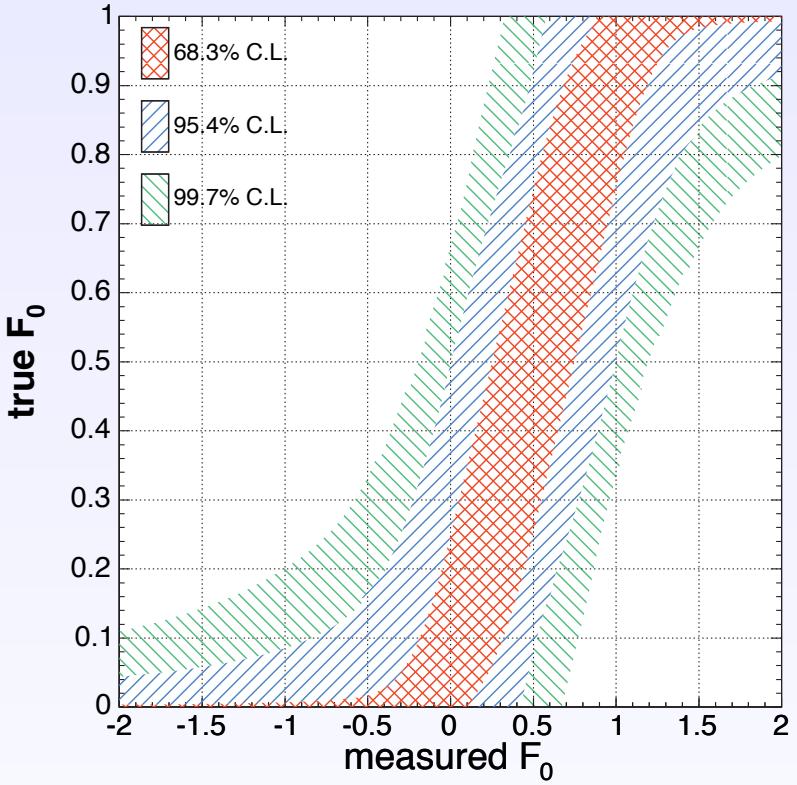
the Feldman-Cousins method

- Where the likelihood-ratio fails to produce an interval within the defined range we will apply the Feldman-Cousins method.
- By construction, this method always produces intervals within the defined range.
- We expect we'll use this to set an upper limit on F_R.
- We already have code which calculates FC intervals given a parameterization of *a-priori* experimental sensitivity.



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Conclusions

- We're moving ahead and hope to stay on schedule for a February 19 pre-blessing.
- Once all the templates are in hand estimates of systematic uncertainty should come quickly (we've done it once already).
- No central values 'till the pre-blessing.
- Please visit the analysis web-page by clicking here.

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